

DETAILED ACTION

Status of Application

This office action is in response to the Applicant's Amendment filed on 11/2/07. Claims 1-7 where claims 1-2 are original, and 3-7 are newly added, are pending and presented for examination.

Response to Arguments

In light of Applicant's amendments to the claims 1-2, filed 11/2/07, the rejection of claims 1-2 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention, has been withdrawn.

In applicant's response, applicant argues that the references fail to teach a piezoelectric sheet having a cubic lead zirconate titanate (PZT) single-crystal particle that "penetrates the plane of said sheet from one side to the other side." Applicants' arguments have been fully considered but are not persuasive for the reason below.

Riman et al. teaches a polycrystalline sheet, formed of a cubic PZT single-crystal particles (a piezoelectric), which inherently penetrate the plane of the sheet from one side to the other (see figure 24). The reference teaches that the particles are deposited on a substrate such as platinum or alumina, and the voids between the particles (see figures 16 and 18) are filled with PZT nanoparticles or a polymer binder (see col 8, lines 60-67 to col 9, lines 1-3). Thus, the polycrystalline material taught by Riman, comprises cubic single crystal PZT particles which "penetrate the plane of the sheet" as the PZT

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particles extend the entire thickness of the taught material, with only the voids in between the particles (and not above or below the particles) comprising a polymer binder matrix (see figures 24 and 124).

Although the claims are amended and new claims are added, the cited reference's teaching is pertinent and still read on amended and new claims. Therefore substantially same art rejection set forth in previous office action has been issued as follows.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. Claims 1-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Riman et al. (US 7,022,303) in view of Wakino (US 5,441,657).

Claims 1 and 2 are drawn to a composite sheet comprising a matrix of a polyimide, silicone rubber, or epoxy resin and cubic lead zirconate titanate single-crystal particles dispersed within, wherein single-crystal particles possess (100) planes parallel to a plane of said sheet and which penetrate fully the plane of the sheet, and where single-crystal particles comprise 50-90% of the volume of said sheet.

As mentioned in previous office action, Riman et al. (US 7,022,303, hereafter Riman) teaches a polycrystalline material comprising a plurality of single-crystal particles of lead zirconium titanate (PZT) (see claim 9) in cubic form (see claim 6) having self-orientation and bonded together to fix said orientation along at least one crystallographic direction (see claim 1), wherein single-crystal particles are bonded together by a polymer phase (see claim 12), wherein single-crystal particles are packed and aligned on the surface of a polymer film (see claim 13) and where said single-crystal particles comprise greater than 65% of the volume of the material. Although the reference does not explicitly state that the cubic PZT single crystal particles penetrate the plane of the sheet from one side to the other side, this is an inherent property of the polycrystalline material taught by Riman (see figure 24). The reference teaches the PZT particles are deposited on a substrate such as platinum or alumina, and the voids between the particles (see figure 16) are filled with PZT nanoparticles or a polymer binder (see col 8, lines 60-67 to col 9, lines 1-3). Thus, the polycrystalline material taught by Riman, comprises single crystal PZT particles which “penetrate the plane of the sheet” as the PZT particles extend the entire thickness of the taught material, with

only the voids in between the particles (and not above or below the particles) comprising a polymer binder matrix (see figure 24 and 124).

In regards to claim 3, Riman teaches that the polycrystalline material comprises PZT particles with the voids in between the particles filled with a polymer binder (see rejection of claim 1 above). Therefore, the particles would inherently extend the thickness of the sheet as they define the thickness of the sheet by their size.

In regards to claims 4-6, Riman teaches a plurality of single crystal particles making up said polycrystalline material (see for example figure 24).

In regards to claim 7, Riman teaches that said cubic particles may have rhombohedral crystal structure (see col 8, lines 13-16).

The claims differ from US 7,022,303 in that it fails to teach a polyimide, silicone rubber, or epoxy resin matrix material as a polymer binder, it also fails to distinctly specify the orientation of as having (100) planes parallel to a plane of the sheet.

However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the material of Riman et al. (a polymer film, claim 12) with a polyimide, silicone rubber, or epoxy resin as taught by Wakino. Wakino discloses a vibration-isolating composite material comprised of inorganic elastic material and a synthetic polymer (claim 1) wherein the synthetic polymer is selected from a polyimide, silicone resin, epoxy resin, etc. (claim 4).

One would have been motivated to make such a modification because of convenience and cost reduction(cost effective manufacturing process) associated with

such substitution where the efficacy of materials such as polyimides, silicone rubbers, and epoxy resins for use in composite materials is well proven by Wakino.

Furthermore, it would have been obvious to one of ordinary skill in the art at the time the invention was made that the cubic single-crystal particles, self-oriented to the plane of the material found in Riman et al. would inherently possess (100) planes parallel to the plane of sheet. Riman teaches the PZT particles with faces parallel to the plane of the sheet (see figures 24 and 124) and it is well known that the faces of a PZT single-crystal cube are composed of (100) planes, as admitted by the instant specification.

Conclusion

All pending claims are rejected. No claims are allowed.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

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the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to John A. Hevey whose telephone number is 571-270-3594. The examiner can normally be reached on Monday - Friday 7:30 AM to 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vickie Kim can be reached on 571-270-0579. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

jah

/Vickie Kim/
Supervisory Patent Examiner, Art Unit 4116